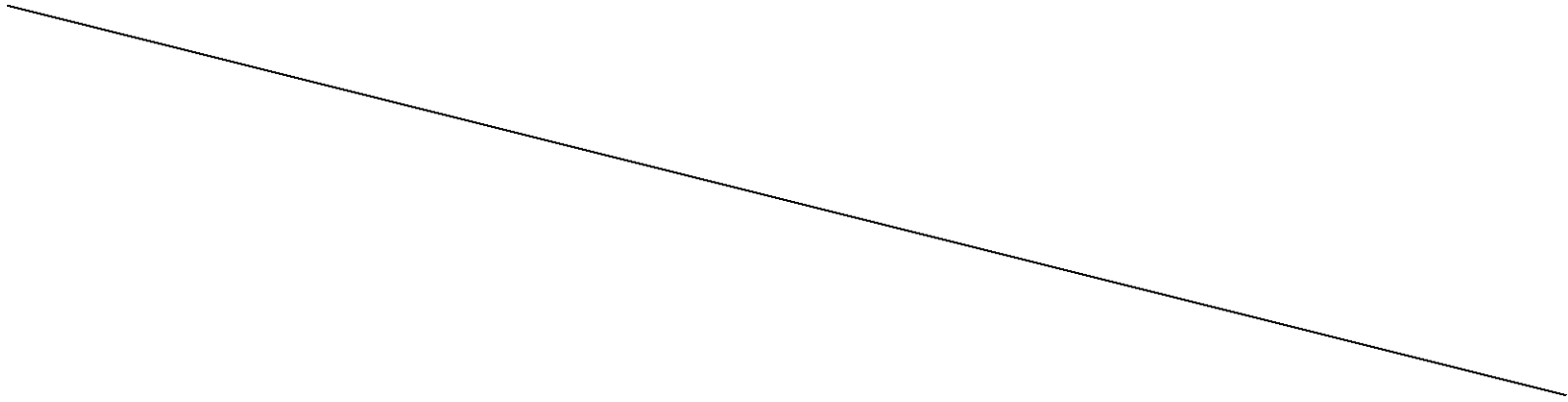

V. DATA PROJECTIONS

A. Introduction

For average schedule settlement formula development, **NECA** used historical demand and accounting data from average schedule study areas. Demand data used were those accepted by NECA from companies for monthly settlements. Accounting data were taken from the financial statements prepared by individual carriers and submitted as a part of NECA's annual data collection. These sources of data are preferred over budgets or forecasts done by the exchange carriers because they reflect each carrier's actual cost and demand levels and reduce the burden on individual study areas caused by additional requests.

NECA used these data to prepare uniformly developed test period projections of account balances and demand. The test period for the 2002 Study **is** the year beginning July 1,2003 and ending June 30, 2004, the period when the settlement formulas from this study would be in effect. Settlement formulas derived from these projected data would be used to calculate monthly settlements for each carrier during the upcoming test period.

This study continues using the stratified method of account growth analysis introduced in the 2000 Study. The **2001** Sample companies were assigned to strata, based on access line size, and a separate set of growth ratios was calculated for each stratum. This stratification improves the overall accuracy of account growth forecasts, because account balance growth tends to vary according to company size.

For additional reliability, NECA computed stratified composite average growth ratios by separately averaging 2001 Sample growth ratios with 2000 Sample growth ratios. These composite growth ratios were then applied to the accounts of individual sample study areas to calculate test period

account values. A description of this method is included in Section V.B.

Test period demand projections were based on trends measured from a multi-year history of the average schedule population. Historical demand data taken from data reported to the NECA pool were used to develop growth models and calculate multi-year growth ratios. These multi-year growth ratios were multiplied by the average base period demand value of each sample average schedule study area to calculate test period demand values. Sections V.C through V.H describe the use of these methods to forecast each demand variable. The forecasted data described in this section were used to calculate test period access category revenue requirements described in Section VI.F, and settlement formulas described in Section VII.

B. Account Forecasting

Year over year growth ratios were calculated for each account in each stratum of the 2001 Sample. Calculation of these ratios involved the Outlier Accommodation Method For Ratio Estimates, described in Section IV.C.2. To lower the variance found in growth ratios computed from a single sample, NECA used composite growth ratios developed by averaging the 2002 Study growth ratios with those developed in the 2001 Study.'

1. Stratification of the 2001 Sample

In the 2000 Study, NECA found that different growth trends were experienced by companies **of** different sizes. NECA introduced stratification into that year's account growth analysis to reflect these differences. The 2002 Study continues using this methodology. Study areas in

the 2001 Sample were separated into three strata based on access line size in December 1999, including all adjustments through December 2001.

To confirm optimum stratification, NECA performed a Sum **of** Squares Test, which measures the variation **of** each study area's growth around the stratum's average growth rate. This test revealed that the revenue requirement growth experienced by companies varied significantly by access line size groupings and that study area growth rates were closer to stratum average rates than to the overall average rate. As a result, NECA determined that improvements to the accuracy **of** account forecasts could continue to be achieved **through** stratification.

NECA then conducted a Variance **of** Ratio Estimate Test, which measured the accuracy improvement obtained by using stratified growth rates. This test was used to identify the breakpoint values that would maximize the growth rate differentiation among strata. Since no other breakpoint Combinations improved upon the growth rate differentiation among strata established during the 2000 Study, NECA continues to calculate separate account growth ratios for the following three strata **of** 2001 Sample companies:

- Stratum 1 - Study Areas with less than 4,000 access lines
- Stratum 2 - Study Areas with between 4,000 and 10,000 access
- Stratum **3** - Study Areas with more than 10,000 access lines

[1] Accounting data supplied by the 2001 Average Schedule Sample are reported in Appendices C1 and C2. Accounting data supplied by the 2000 Average Schedule Sample are reported in Appendices C4 and C5.

2. Account Adiustments

NECA adjusted some total company accounts reported by sample study areas to remove costs not included in cost studies and apportioned some accounts to subaccounts that were not provided by sample average schedule companies.

- The non-operating portion of Interest and Related Items was removed from total Interest and Related Items, by calculating the average ratio of Operating Fixed Charges to Total Fixed Charges reported by sample cost companies. That ratio, 0.992739, described in Section IV.F.l, was multiplied by the Total Interest and Related Items account balances reported by average schedule companies. The resultant amount is Operating Interest and Related Items.

- The FCC rules governing the calculation of interstate revenue requirements mandate different treatment for Interest on Customer Deposits than for other Operating Interest and Related Items.[2] Since sample average schedule companies do not provide separate subaccount data for Interest on Customer Deposits, this subaccount was derived by applying a factor, 0.007261, to Operating Interest and Related Items. This factor was derived for this purpose from sample cost company cost studies, as described in Section IV.F.2.

- The amount of Federal Investment Tax Credits (FITC) for average schedule companies was derived based on the average ratio of FITC to Net Investment reported by sample cost companies. The development of this ratio, 0.000529, was discussed in

[2] ***See*** 47 C.F.R. §§ *65.820* and *65.830.*

Section IV.F.3.

- The amount of Charitable Contributions included in Account 7370, Non-Operating Income and Expense, was derived based on the average ratio of Contributions to Expenses and Other Taxes reported by sample cost companies. The development of this ratio, 0.001782, was discussed in Section IV.F.4.

- The account balances of Information Origination/Termination investment and expense were set to zero for all sample study areas, because the trend of reduction displayed by these accounts would produce zero account balances during the July 2003 to June 2004 test period.

- The amount of State Income Taxes (SIT) for sample Subchapter **S** companies was derived based on the average ratio of SIT to Expense (Plant Specific expense, Non-Plant Specific expense, Customer Operations expense, Corporate Operations expense plus Depreciation & Amortization expense) reported by other Sample average schedule companies. The resulting factors **of** 0.039826 for 2000 and 0.040925 for 1999 were multiplied by Expense to calculate **SIT** for each sample Subchapter **S** study area.

3. Identification and Accommodation of Outliers

Annual growth ratios were calculated for Part 32 accounts using 1999 and 2000 accounting data from the 2001 Sample. To ensure that no company's data exerted undue influence on these ratios, NECA applied an Outlier Accommodation Method, first introduced in the 1998

Study and described in Section **IV.C.2,** which reduced the relative weight of highly influential points and allowed them to be included in account growth ratio development.

In the first step of this process, **NECA** computed **1999** and **2000** unseparated revenue requirement amounts for each 2001 Sample study area in each stratum, using the revenue requirement calculation method described in Section VLF of this Filing. **An** average unseparated revenue requirement growth ratio was calculated for each stratum of the **2001** Sample as follows:

$$2001\,Sample\,Average\,Revenue\,Requirement\,Growth\,Ratio, = \frac{\sum_{Stratum_i} (Sample\,Weight_i \times Variance\,Weight_i \times 2000\,Unseparated\,Revenue\,Requirement)}{\sum_{Stratum_i} (Sample\,Weight_i \times Variance\,Weight_i \times 1999\,Unseparated\,Revenue\,Requirement)}$$

Variance weights, which quantify study area specific growth relative to the average growth within a stratum, were obtained by applying the Outlier Accommodation Method For Ratio Estimates (described in Section IV.C.2). These variance weights, which were calculated based on relative growth in unseparated revenue requirement, were then used in the calculation of all account growth ratios.

4. Account Groupinas

A separate annual growth ratio was computed for most accounts using the combined ratio estimate technique, described in Section V.B.5. The remaining accounts, which typically exhibited wider than average variations in year over year growth from sample to sample,

were assigned to account groupings and then a growth ratio for each group was calculated. Exhibit 5.1 shows the account groupings used.

EXHIBIT 5.1

ACCOUNT GROUPINGS FOR GROWTH CALCULATION

Account Group	Accounts Included in Group	**Part 32** Account Number
Accumulated Depreciation & Amortization	Accumulated Depreciation - Telecommunications Plant in Service	3100
	Accumulated Depreciation - Held for Future Telecommunications Use	3200
	Accumulated Amortization - Tangible	3400
	Accumulated Amortization - Intangible	3500
	Accumulated Amortization - Other	3600
Plant Specific Expense	Network Support Expense	6110
	General Support Expense	6120
	Central Office Equipment Expense	6210,6220,6230
	Cable & Wire Facilities Expense	6410
Plant Non-Specific Expense	Other Properly, Plant and Equipment Expense	6510
	Network Operations Expense	6530
Customer Operations Expense	Marketing Expense	6610
	Services Expense	6620
Corporate Operations Expense	Executive & Planning Expense	6710
	General & Administrative Expense	6720
Other Telecommunications Plant	Deferred Maintenance and Retirement	1438
	Property Held for Future Telecommunications Use	2002
	Telecommunications Plant Under Construction	2003
	Telecommunications Plant Adjustment	2005
Other Operating Taxes	Operating State and Local Income Taxes	7230
	operating Other Taxes	7240
Net Deferred Income Taxes	Net Current Deferred Operating Income Taxes	4100
	Net Non-Current Deferred Operating Income Taxes	4340
	Other Jurisdictional Liabilities and Deferred Credits	4370
Total Plant	Materials & Supplies	1220
	RTB Stock	1402
	Telecommunications Plant in Service	2001
	Other Telecommunications Plant	2002,2003,2005

5. The 2001 Sample Stratified Annual Growth Ratios

NECA used the combined ratio estimate technique to determine stratified annual growth rates. For the 2001 Sample, the Stratified Annual Growth Ratios were calculated within each stratum, using the following formula:

$$2001\ \textit{Sample Stratified Annual Growth Ratio,} = \frac{\sum_{Stratum_i} (\textit{Sample Weight}_i \times \textit{Variance Weight,} \times 2000\ \textit{Account Balance,})}{\sum_{Stratum_i} (\textit{Sample Weight,} \times \textit{Variance Weight,} \times 1999\ \textit{Account Balance,})}$$

Columns C, G and K of Exhibit 5.2 display the resulting 2001 Sample Stratified Annual Growth Ratios for each of the three access line size strata.

6. The 2002 Study Stratified Composite Growth Ratios

NECA uses composite growth ratios from **two** annual samples to provide more stable account growth estimates and substantially smaller statistical variance. Derivation of composite growth rates entails adjusting 2000 Sample annual straight line growth ratios to the next year, and averaging these adjusted growth ratios with the 2001 Sample Stratified Growth Ratios.

EXHIBIT 5.2

AVERAGE SCHEDULE ACCOUNT GROWTH RATIOS

	Small S	dy Areas		
Account	(A) *2000* Sample Annual Growth	(B) *2000* Sample Adjusted Growth	(C) 2001 Sample Annual Growth	(D) 2001 Composite Growth
TelecommunicationsPlant In Service	1.0798	1.0739	1.0792	1.0766
General Support Facilities	1.0714	1.0666	1.0822	1.0744
Central Office Equipment	1.0628	1.0591	1.0742	1.0666
Cable & Wire Facilities	1.0951	1.0868	1.0821	1.0845
Tangibles	1.0000	1.0000	1.0000	1.0000
Intangibles	1.0628	1.0591	1.0742	1.0666
Materials And Supplies	1.1211	1.1080	1.3365	1.2223
Rural Telephone Bank Stock	1.0165	1.0162	0.9705	0.9934
Other TelecommunicationsPlant	1.0784	1.0727	1.0809	1.0768
Total TelecommunicationsPlant	1.0784	1.0727	1.0809	1.0768
Other Non-Current Assets	1.0799	1.0740	1.0601	1.0670
Accum. Depreciation & Amortization	1.0766	1.0711	1.1070	1.0891
Net Telecommunications Plant	1.0799	1.0740	1.0601	1.0670
Net Deferred Operating Income **Tax**	1.0828	1.0765	0.9745	1.0255
Plant Specific Expense	1.1046	1.0947	1.0575	1.0761
Plant Non-specific Expense	1.1148	1.1030	1.1071	1.1050
Customer Service Expense	1.0614	1.0578	1.0919	1.0749
Corporate Operations Expense	1.0310	1.0301	1.0823	1.0562
Depreciation & Amortization Expense	1.0617	1.0581	1.0483	1.0532
Charitable Contributions	1.0784	1.0727	1.0809	1.0768
Interest &Related Items	0.9487	0.9459	1.0641	1.0050
Patronage Dividends	1.0799	1.0740	***1.0601***	1.0670
Interest On Customer Deposits	0.9487	0.9459	1.0641	1.0050
Other Long Term Liabilities	1.0799	1.0740	1.0601	1.0670
Federal Investment Tax Credits	1.0799	1.0740	1.0601	1.0670
Other Operating Taxes	1.0002	1.0002	0.9998	1.0000
Allow. For Funds Used During Const.	1.0784	1.0727	1.0809	1.0768
Expenses & Other Taxes	1.0656	1.0616	1.0702	1.0659
Revenue Requirement	1.0678	1.0635	1.0639	1.0637

EXHIBIT 5.2

AVERAGE SCHEDULE ACCOUNT GROWTH RATIOS

(ntinued)

	Medium Study Areas			
Account	(E) 2000 Sample Annual Growth	(F) 2000 Sample Adjusted Growth	(G) 2001 Sample Annual Growth	(H) 2001 Composite Growth
Telecommunications Plant In Service	1.0714	1.0666	1.0863	1.0765
General Support Facilities	1.0446	1.0427	1.0512	1.0469
Central Office Equipment	1.0801	1.0742	1.0972	1.0857
Cable & Wire Facilities	1.0724	1.0675	1.0888	1.0782
Tangibles	1.0213	1.0209	1.0000	1.0104
Intangibles	1.0801	1.0742	1.0972	1.0857
Materials And Supplies	1.0071	1.0070	1.3255	1.1663
Rural Telephone Bank Stock	1.0214	1.0210	1.0485	1.0347
Other Telecommunications Plant	1.0709	1.0662	1.0873	1.0768
Total Telecommunications Plant	1.0709	1.0662	1.0873	1.0768
Other Non-Current Assets	1.0383	1.0369	1.0766	1.0567
Accum Depreciation & Amortization	1.1080	1.0975	1.0817	1.0896
Net Telecommunications Plant	1.0383	1.0369	1.0766	1.0567
Net Deferred Operating Income Tax	1.0016	1.0016	1.2573	1.1294
Plant Specific Expense	1.1083	1.0977	1.1435	1.1206
Plant Non-specific Expense	1.0353	1.0341	1.0399	1.0370
Customer Service Expense	1.1449	1.1266	1.0421	1.0843
Corporate Operations Expense	1.0769	1.0714	1.0041	1.0378
Depreciation & Amortization Expense	1.1028	1.0932	1.0634	1.0783
Charitable Contributions	1.0709	1.0662	1.0873	1.0768
Interest & Related Items	0.9739	0.9732	0.9719	0.9726
Patronage Dividends	1.0383	1.0369	1.0766	1.0567
Interest On Customer Deposits	0.9739	0.9732	0.9719	0.9726
Other Long Term Liabilities	1.0383	1.0369	1.0766	1.0567
Federal Investment Tax Credits	1.0383	1.0369	1.0766	1.0567
Other Operating Taxes	1.0735	1.0685	1.0697	1.0691
Allow. For Funds Used During Const.	1.0709	1.0662	1.0873	1.0768
Expenses & Other Taxes	1.0993	1.0903	1.0616	1.0760
Revenue Requirement	1.0845	1.0779	1.0681	1.0730

EXHIBIT 5.2

AVERAGE SCHEDULE ACCOUNT GROWTH RATIOS
(Continued)

	Large Si	y Areas		
Account	(I) 2000 Sample Annual Growth	(J) 2000 Sample Adjusted Growth	(K) 2001 Sample Annual Growth	(L) 2001 Composite Growth
Telecommunications Plant In Service	1.0732	1.0682	1.0752	1.0717
General Support Facilities	1.0838	1.0773	1.0484	1.0629
Central Office Equipment	1.0865	1.0796	1.0869	1.0833
Cable & Wire Facilities	1.0618	1.0582	1.0742	1.0662
Tangibles	0.7909	0.7356	1.0000	0.8678
Intangibles	1.0865	1.0796	1.0869	1.0833
Materials And Supplies	1.0817	1.0755	1.5929	1.3342
Rural Telephone Bank Stock	1.0171	1.0168	0.9754	0.9961
Other TelecommunicationsPlant	1.0735	1.0685	1.0805	1.0745
Total Telecommunications Plant	1.0735	1.0685	1.0805	1.0745
Other Non-Current Assets	1.0589	1.0556	1.0557	1.0557
Accum Depreciation & Amortization	1.0911	1.0835	1.1065	1.0950
Net TelecommunicationsPlant	1.0589	1.0556	1.0557	1.0557
Net Deferred Operating Income Tax	1.0180	1.0177	1.0469	1.0323
Plant Specific Expense	1.0563	1.0533	1.0789	1.0661
Plant Non-specific Expense	1.0505	1.0481	1.1056	1.0768
Customer Service Expense	1.0370	1.0357	1.1019	1.0688
Corporate Operations Expense	1.0668	1.0626	1.0282	1.0454
Depreciation & Amortization Expense	1.0980	1.0893	1.0726	1.0809
Charitable Contributions	1.0735	1.0685	1.0805	1.0745
Interest & Related Items	0.9106	0.9018	1.0071	0.9545
Patronage Dividends	1.0589	1.0556	1.0557	1.0557
Interest On Customer Deposits	0.9106	0.9018	1.0071	0.9545
Other Long Term Liabilities	1.0589	1.0556	1.0557	1.0557
Federal Investment Tax Credits	1.0589	1.0556	1.0557	1.0557
Other Operating Taxes	1.0666	1.0624	1.0315	1.0470
Allow. For Funds Used During Const.	1.0735	1.0685	1.0805	1.0745
Expenses & Other Taxes	1.0688	1.0644	1.0732	1.0688
Revenue Requirement	1.0693	1.0648	1.0669	1.0659

The 2000 Sample Stratified Annual Growth Ratios, representing growth from 1998 to 1999, are shown in Columns A, E and I of Exhibit 5.2. Each of these growth ratios was adjusted forward one year to reflect the equivalent straight line rate of growth from 1999 to 2000. This adjustment method is illustrated in Exhibit 5.3, using the Central Office Equipment (COE) investment growth ratio for small study areas, as an example.[3] Adjusted 2000 Sample Stratified Annual Growth Ratios are displayed in Columns B, F and J of Exhibit 5.2.

EXHIBIT 5.3

ADJUSTMENT OF 2000 SAMPLE STRATIFIED ANNUAL GROWTH RATIOS FOR STUDY AREAS WITH LESS THAN 4,000 ACCESS LINES USING COE INVESTMENT AS AN EXAMPLE

A. 2000 Sample Stratified Small Company Annual Growth Ratios (1998 to 1998)	1.0628
B. 2000 Sample Stratified Small Company Two Year Growth Ratios (1998 to 2000) {(2 x (Line A - 1)} + 1	1.1256
C. Adjusted 2000 Sample Stratified Small Company Annual Growth Ratio (Line B/Line A)	1.0591

This Study developed composite growth ratios for each account within each access line size stratum. A composite growth ratio is the arithmetic average of the Adjusted 2000 Sample Stratified Annual Growth Ratio and the related 2001 Sample Stratified Annual Growth Ratio.

An example of the composite growth ratio calculation, using the growth in COE investment reported by study areas with less than 4,000 access lines follows.

[3] NECA used a straight-line forecasting method to project average schedule accounts, because it has less **risk** of over-estimating accounts.

2002 Study Stratified Composite Growth Ratio for Stratum 1

= *(Adjusted 2000 Stratified Stratum 1 Growth Ratio*
+ 2001 Stratified Stratum 1 Annual Growth Ratio} / 2

= ***(1.0591t** 1.0742)/ 2*

= *1.0666*

The 2001 Study Stratified Composite Growth Ratios are displayed in Columns D, H and L of Exhibit 5.2.

7. Other Growth Rates

For some accounting data from smaller accounts that exhibit significant year over year growth variation, NECA used growth ratios derived from other logically related accounts ***to*** reduce significant sample variance.

- The test period values **for** Contributions, Allowance for Funds Used During Construction and Other Telecommunications Plant were calculated using the growth rate calculated for Total Plant.

- Interest on Customer Deposits values were projected using the growth rate developed for Interest and Related Items.

- Patronage Dividends, Federal Lnvestment Tax Credit, Other Non-Current Assets and Other Long Term Liabilities were projected at the same rate as Net Plant.

- Test period values for Provision for Deferred Operating Income Taxes were calculated using the Other Taxes growth ratio.

8. Stratified Multi-vear Growth Ratios

NECA derived stratified multi-year growth ratios to estimate test period costs om the historical accounting data submitted by study areas. For the 1999 accounts submitted by the 2000 Sample, the multi-year growth rates reflect the fact that the test period extends four and one-half years beyond the end of 1999. For accounts in each stratum of the 2001 Sample multi-year growth ratios reflect three and one-half years between the end of 2000 and the test period. The calculation for multi-year growth ratios is as follows:

For 2000 Accounts:

$$2000\ Stratified\ Multi\text{-}year\ Growth\ Ratio_i = 1 + [(2002\ Study\ Stratified\ Composite\ Growth\ Ratio_i - 1) \times 3.5]$$

For 1999 Accounts:

$$1999\ Stratified\ Multi\text{-}year\ Growth\ Ratio_i = 1 + [(2001\ Study\ Stratified\ Composite\ Growth\ Ratio_i - 1) \times 4.5]$$

9. Account Forecasting

NECA prepared a forecast of each account for each sample study area. The forecasted data represents the average month of the test **period.** Prior to forecasting, study areas included in the 2000 Sample were separated into access line size stratum based on the number of lines reported in the final view (December 2001) of settlements in December 1999. The forecasted

amounts in each stratum were computed by multiplying the 1999 account balance by the 1999 Stratified Multi-year Growth Ratio by stratum.

Similarly, study areas from the 2001 Sample were first assigned to an access line stratum and then projected to the test period by multiplying the 2000 account balance by the corresponding multi-year growth ratio. The set of composite multi-year growth ratios used to project a study area's account balances from the 2001 Sample were chosen based on the study area's access line size, as reported for settlements in December 1999 and including all adjustments through December 2001.

Study Area Forecast of 2000 Account =

(Study Area 2000 Account Value) x (2000 Stratified Multi-year Growth Ratio$_i$)

Study Area Forecast of 1999 Account =

(Study Area 1999 Account Value) x (1999 Stratified Multi-year Growth Ratio:)

Section VI.F describes the computation of revenue requirements using forecasted accounts.

C. Access Minute Forecasting

To forecast traffic sensitive access minutes of use, NECA developed an econometric model based on the historical growth of access minutes from the average schedule population. This model was used to prepare an Access Minute Growth Ratio, which was used to forecast Average Schedule sample

study area minutes to the test period.[4] The modeling process and calculation of forecasts are described below.

1. Econometric Model for Access Minutes

Traffic sensitive access minutes data reported to the NECA pool by the population[5] of average schedule companies from July 1998 through August 2002, including all adjustments through September 2002, were used to develop the model. These data are displayed in Appendix D4.

In this model, the Natural Log of access minutes was the dependent variable. The independent variables were Natural Log of Real Disposable Personal Income (Income), Natural Log of Real Price Index (Price), Natural Log of Real Price of Cellular Services, Natural Log of Employment, a constant term, a Nationwide Cellular Calling Plan dummy variable and eleven seasonal dummy variables. The price, income and employment variables are national aggregates. To perform these calculations, the following data were used:

1. Consumer Price Index (CPI) – This variable is a measure of the rate of inflation obtained from Regional Financial Associates (RFA). The September 2002 view was used. The U.S. Government, Bureau of Labor Statistics (BLS), provides the historical

4 Access Minute Growth Ratios for NECA average schedule companies were derived using the econometric modeling techniques that **support NECA's** Annual Tariff Filing. See, *e.g.*, National Exchange Carrier Association, Inc., Tariff F.C.C. No. 5, Transmittal NO. 939, filed June 17,2002 at Vol. 3, Sec. 3, **p.** 12.

5 NECA did not use outlier accommodation during the development of growth models for demand data. Data points in demand trend analyses were population aggregate values by month, which are virtually free from influence by changes of individual study areas.

data, while RFA develops the forecasted data. The CPI was used in the econometric model to remove the impact of inflation while creating the Real Price Index and Real Income variables.

2. Real Price Index – This variable is calculated using the Nominal Price series adjusted for inflation. The Nominal Price series is obtained from the September 2002 view of the month-to-month percent change in the Telecommunications Producer Price Index for Interstate and International Services, provided by the BLS. Real prices were then calculated as the ratio of Nominal Price to the CPI.

3. Real Income – This variable is supplied by RFA and is calculated using the September 2002 view of historical and forecasted nominal disposable personal income, divided by the CPI to adjust for inflation.

4. Employment – This variable is compiled by the BLS and projected by the RFA using a model that links employment levels to the September 2002 view of growth in Gross Disposable and National Income.

5. Real Price Index of Cellular Services – This variable captures the impact of cellular telephone usage on test period Traffic Sensitive switched minutes of use estimates for average schedule study areas. The variable was constructed by splicing together two separate series: a series developed from the Cellular Telecommunications & Internet Association (CTIA) semi-annual data on Average Local Monthly Bills[6] and the

[6] Cellular Telecommunications & Internet Association, The CTIA Semi-Annual Wireless Industry Survey - Semi-Annual Wireless Industry Results - June 1985 to June 2001, October 2001. http://www.wow-com.com/industry/stats/articles.cfm?ID=239

Bureau of Labor Statistics (BLS) series for "Cellular and other wireless voice grade services".' The CTIA series was created by linearly interpolating the data collected bi-annually from June 1987 through June 1999. The BLS series has been reported from June 1999 to the present. Future values of cellular prices were estimated using an exponential time trend model.[8] The complete spliced series was converted into a real price series by dividing the nominal cellular price indices by the Consumer Price Index.

6. Nationwide Cellular Calling Plans Dummy Variable – This variable captures the impact on access minute growth of the introduction of nationwide calling plans **by** cellular service providers beginning in November 1999.

7. Seasonal Dummy Variables - One dummy variable for each of the months from February through December, used to capture monthly patterns in the data relative to January.

---

7 Monica Gabor, ***et.*** *al.*, Producer Price Index Detailed Report – Data for September 2001, U.S. Department of Labor, Bureau of Labor Statistics, Cellular and Other Wireless Voice Grade Services, Series ID: pcu4812#1, 1999 to 2001, August 2002. http://data.bls.gov/cgi-bin/srgate

8 The model used to forecast future values of cellular prices is as follows:

$$Log\ of\ \textbf{Cellular Prices} = 4.579640 + (-0.003798 * Log\ of\ \textbf{Month Sequence})$$

$R^2 = 0.8774$ ***t-statistic for Intercept = -5.20*** ***F-statistic 12.91***
t-statistic for Sequence = 250.10

Where Month Sequence 1 = July 1999

The price, income, cellular price and employment variables were transformed using polynomially distributed lags: lag length three for price and income and lag length twelve for cellular prices and employment, with degree two for each variable! The model was corrected for autocorrelation.

The coefficient of each independent variable in the model is its elasticity relative to access minutes, and represents the percent change in access minutes resulting from a percent change in each independent variable.

Model coefficients together with the diagnostic ***t-statistic, F-statistic and R-Square*** statistics are given in Exhibit **5.4.** The model fits the data well, **explaining 94.70** percent of the variance in access minutes. The F-statistic of **37.74** shows that this regression is statistically significant at the 99 percent confidence level.

[9] **A** polynomial is a sum of terms expressed as consecutive powers of a variable (*e.g.*, $x + x^2 + x^3 + ...$). **A** polynomial has degree two if the highest power of the variable is two. **A** lag is a time offset of one time series from another. For example, a time series of spending data could lag corresponding changes in income by several months. **A** distribution of lags over several months is employed when the demand response to an economic change is not instantaneous. The polynomially distributed lag technique specifies the shape **of** the distribution of lags. Selection of the degree of the polynomial, the initial and terminal periods for the series of lag coefficients, and consequently the length of the lag, determine the shape of the lag. In this study lags distributed over three months for price and over nine months for income, according to a second degree polynomial pattern, fit the data best.